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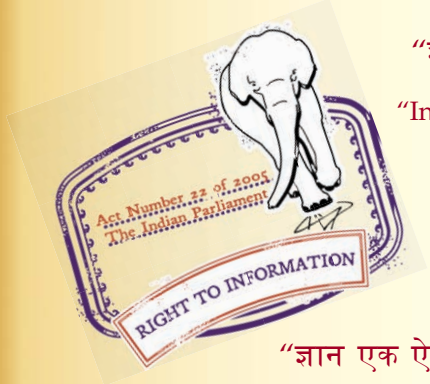
IS 302-2-76 (1999): Safety of Household and Similar Electrical Appliances, Part 2: Particular Requirements, Section 76: Electric Fence Energizers [ETD 32: Electrical Appliances]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 302-2-76 (1999)

(Reaffirmed 2004)

भारतीय मानक

घरेलू और समान विद्युत साधित्रों की सुरक्षा

भाग 2 विशेष अपेक्षाएँ

अनुभाग 76 बिजली के बाड़ा उर्जायक

Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 2 PARTICULAR REQUIREMENTS

Section 76 Electric Fence Energizers

ICS 65.040.99

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1999

Price Group 9

FOREWORD

This Indian Standard (Part 2/Sec 76) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the general and safety requirements for electric fence energizers. This standard is to be read in conjunction with IS 302-1 (1979) 'Safety of household and similar, electrical appliances : Part 1 General requirements (*fifth revision*). For the sake of convenience, the clauses of this standard corresponds to those of IS 302-1 (1979), instead of reproducing full text of each clause, clauses of IS 302-1 (1979) which are applicable (which means that relevant provisions of the clause apply) or not applicable and the sub-clauses or portions thereof which are not applicable are indicated as under:

a) In case of clause, where it is applicable or not applicable, the wording used is 'This clause of IS 302-1 (1979) is applicable/not applicable'; and

b) In case of a sub-clause or part thereof 'Not applicable'. Wherever a sub-clause of IS 302-1 (1979) is to be replaced by a new text, it has been indicated as under:

'Replacement — followed by the new text'. Any addition to the existing provisions of a sub-clause of IS 302-1 (1979) has been indicated as under:

'Addition — followed by the text of the additional matter'.

Clauses/tables which are additional to those of IS 302-1 (1979) are numbered starting from 101 and additional sub-clauses are numbered with the main clauses number followed by 101, 102 etc, for example **7.101**.

Should, however, any deviation exist between IS 302-1 (1979) and this standard, the provisions of the latter shall apply.

While preparing this standard, assistance has been derived from IEC 335-2-76 (1997) 'Safety of household and similar electrical equipment : Part 2 Particular requirements, Section 76 Electric fence energizers' issued by the International Electrotechnical Commission (IEC).

The Indian Standards which are necessary adjuncts to this standard are given in Annex-BB.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 2 PARTICULAR REQUIREMENTS

Section 76 Electric Fence Energizers

1 SCOPE

This clause of IS 302-1 (1979) is applicable except as follows.

1.1 Replacement

This standard deals with the safety of electric fence energizers, the rated voltage of which is not more than 250 V and by means of which fence wires in agricultural, feral animal control and security fences may be electrified or monitored.

NOTE — Examples of electric fence energizers coming within the scope of this standard are:

— Mains-operated energizers:

— Battery-operated electric fence energizers suitable for connection to the mains, as shown in Fig. 101:

— Electric fence energizers operated by non-rechargeable batteries either incorporated or separate.

This standard does not in general take into account

— the use of appliances by young children or infirm persons without supervision:

— playing with appliances by young children.

NOTES

1 Attention is drawn to the fact that

— for appliances intended to be used on board ships or aircraft, additional requirements may be necessary:

2 This standard does not apply to

— appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);

— separate battery chargers;

— electric fishing machines;

— electric animal-stunning equipment; and

— appliances for medical purposes.

2 TERMINOLOGY

This clause of IS 302-1 (1979) is applicable except as follows.

2.1 Addition

For type D energizers, the rated voltage of the energizer is the rated voltage for battery supply.

2.5 Addition

For battery-operated electric fence energizers not for connection to the mains, it is the average input current assigned to the energizer by the manufacturer.

2.10 Addition

NOTES

— The supply cord may be specially prepared and only available from the manufacturer or its service agent.

— A specially prepared cord may also include a part of the appliance.

2.17 Addition

NOTE — In class II electric fence energizers provision may be made for connecting at least one of the output terminals to the earth electrode.

2.29 to 2.34 Not applicable.

2.37 to 2.41 Not applicable.

2.46 Not applicable.

2.47 Addition

It also includes terminals for the connection of the battery and other metal parts in a battery compartment, which become accessible when replacing batteries even with the aid of a tool.

Additional Sub-clauses

2.101 Live Part

Conductive part, which may cause an electric shock.

2.102 Normal Operation

Operation of the appliance under the following conditions: the electric fence energizer is operated as in normal use when connected to the supply, with no load connected to the output terminals.

2.103 Electric Fence Energizer

Appliance which is intended to deliver periodically

voltage impulses to a fence connected to it.

NOTE — Electric fence energizers are hereinafter also referred to as energizers.

2.104 Mains-Operated Energizer

Energizer designed for direct connection to the mains.

2.105 Battery-Operated Energizer Suitable for Connection to the Mains: Energizer

— operated by batteries and having, or being designed for connection to, facilities for charging these batteries from the mains, or

— designed for operation from the mains and from batteries.

2.106 Type A Energizer

Battery-operated energizer suitable for connection to the mains consisting of an impulse generating circuit, a battery when the energizer is in operation.

NOTE — Type A energizers are shown schematically in Fig. 101.

2.107 Type B Energizer

Battery-operated energizer suitable for connection to the mains consisting of an impulse generating circuit, a battery charging circuit and a battery, the impulse generating circuit being connected to the battery and disconnected from the battery charging circuit and the mains when the energizer is in operation. For recharging the battery the impulse generating circuit is disconnected and rendered inoperable.

NOTE — Type B energizers are shown schematically in Fig. 101.

2.108 Type C Energizer

Battery-operated energizer suitable for connection to the mains consisting of an impulse generating circuit and a battery, the impulse generating circuit being connected to the mains for the battery when the energizer is in operation, and where it is necessary to remove the battery to recharge it using a separate battery charger or, in the case of a non-rechargeable battery, to replace it with a new battery.

NOTE — Type C energizers are shown schematically in Fig. 101.

2.109 Type D Energizer

Battery-operated energizer suitable for connection to the mains consisting of an impulse generating circuit and a battery, the impulse generating circuit being connected to the battery when the energizer is in operation, and the energizer or the battery being connected to a separate battery charger for recharging the battery.

NOTE — Type D energizers are shown schematically in Fig. 101.

2.110 Battery-Operated Energizer

Energizer deriving its energy solely from batteries or other sources of energy and not designed for connection to the mains.

2.111 Battery Charger

Appliance to be connected to the mains and intended for charging one or more batteries. Not for connection to energizer directly.

NOTE — This also includes Solar PV Modulus and its circuitry for charging batteries.

2.112 Fence

Barrier for animals or for security purposes, comprising one or more conductors, such as metal wires, rods or rails.

2.113 Fence Circuit

All conductive parts or components within an energizer, which are connected or intended to be connected galvanically to the output terminals.

2.114 Earth Electrode

Metal structure that is driven into the ground near an energizer and connected electrically to the output earth terminal of the energizer, and that is independent of other earthing arrangements.

2.115 Prospective Peak Voltage

Peak output voltage of the impulse generator specified in 14 that would be obtained with the energizer not connected to the test circuit.

2.116 Rated Voltage for Battery Supply

Voltage for battery supply, for types A, B, C and D energizers, assigned to the energizer by the manufacturer.

2.117 Rated Voltage Range for Battery Supply

Voltage for battery supply, for types A, B, C and D energizers, assigned to the energizer by the manufacturer, expressed by its lower and upper limits.

2.118 Impulse Duration

Duration of that part of the impulse which contains 95 percent of the overall energy and is the shortest interval of integration of I(t) that gives 95 percent of the integration of I(t) over the total impulse.

NOTE — I(t) is the impulse current as a function of time.

2.119 Output Current

RMS value of the output current per impulse calculated over the impulse duration.

2.120 Medium Power Energizer

Energizer which has an output energy per impulse not exceeding 5J when measured in the 500 ohm component of the standard load.

2.121 Standard Load

Load consisting of a non-conductive resistor of 500 ± 2.5 ohm and a variable resistor which is adjusted so as to maximize the energy per impulse or output current in the 500 ohm resistor, as applicable. The variable resistor is connected in series or parallel with the 500 ohm resistor, whichever gives the more unfavourable result.

2.122 Interconnection Cord

External flexible cord provided as part of a complete appliance for purposes other than connection to the supply mains.

NOTE — A remote hand-held switching device, as external interconnection between two parts of an appliance and a cord connecting an appliance and a cord connecting an accessory to the appliance or to a separate signalling circuit are examples of interconnection cords.

2.123 User Maintenance

Any maintenance operation stated in the instructions for use or marked on the appliance which the manufacturer of the appliance intends the user to perform.

2.124 Electronic Component

Part in which conduction is achieved principally by electrons moving through a vacuum, gas or semiconductor.

NOTE — Neon indicators are not considered to be electronic components.

2.125 Electronic Circuit

Circuit incorporating at least one electronic component.

3 GENERAL REQUIREMENT

This clause of IS 302-1 (1979) is applicable.

4 GENERAL CONDITIONS FOR THE TESTS

This clause of IS 302-1 (1979) is applicable except as follows.

4.2 Modification

Replace the test specification by the following:

The tests are made on two energizers as delivered, one being subjected to all the tests with the exception of that of **18**, and the other to the tests of **5** and **18**. However, the tests of **22** to **28** may be made on separate samples.

For types A and C energizers, an additional sample is required for the test of **18**.

Addition

NOTE — Where electronic circuits, electronic components or other devices are normally encapsulated, specially prepared samples may be needed for the tests of **19.11** and **19.101**.

4.3 Addition

If any electronic component has been damaged during the tests of **14**, the tests of **19** are made twice, once before and once after the damaged electronic components have been replaced by new electronic components.

4.4 Addition

The energizer is mounted in a normal position such that the deviation from the position for which it is designed does not exceed 15°. However, if the energizer is provided with means for adjustment to the normal position, such as a spirit level, the energizer shall be adjusted to within ±2° of the normal position.

The earthing terminal of the fence circuit is connected to earth. However, if there is no indication as to which of the output terminals is to be connected to earth, the terminal, which gives the most unfavourable result is earthed.

4.5 Addition

For types A,B,C and D energizers where the terminals for the connection of the battery have no indication of polarity, application of the more unfavourable polarity of the voltage source replacing the battery.

For battery-operated energizers where the supply terminals for the connection of the battery have no indication of polarity, application of the more unfavourable polarity.

For mains-operated energizers and battery-operated energizers suitable for connection to the mains, the reference source impedance of the mains supply shall be 0.4 ohm + j0.25 ohm.

4.101 Unless otherwise specified, all energizers are tested as motor-operated appliances.

5 RATING

This clause of IS 302-1 (1979) is applicable

except as follows:

5.1 and **5.2** not applicable.

5.101 The energizer output characteristics shall be such that

— the impulse repetition rate shall not exceed 1 Hz;

— the output voltage of the energizer shall not exceed 10 000V;

— the impulse duration of the impulse in the 500 ohm component of the standard load shall not exceed 0.1s;

— for medium power energizers the energy per impulse in the 500 ohm component of the standard load shall not exceed 5 J;

— for other energizers the output current in the 500 ohm component of the standard load;

- shall not exceed the limiting value specified by line C_2 of Fig. 22 of IS 8437 (Parts 1 and 2);
- for an impulse duration of less than 0.1 ms, shall not exceed the current obtained from line from C_2 of Fig. 22 of IS 8437 (Parts 1 and 2) for an impulse duration of 0.1ms.

Compliance is checked by measurement when the energizer is supplied with the voltage in **11.5**, the energizer being operated under conditions of normal operation but with the standard load connected to its output terminals. When measuring the impulse repetition rate the standard load is not connected.

The measurement are made using a measuring arrangement with an input impedance consisting of a non-inductive resistance of not less than 1M ohm in parallel with a capacitance of not more than 100 pF.

5.102 If the energizer is provided with more than one fence circuit, the output characteristics shall be within the limits specified in **5.101** for any possible connection of the fence circuits.

The impulses for the individual sets of output terminals shall be synchronized and

— the impulse duration shall not exceed the value specified in **5.101**,

— the impulse repetition rate shall not exceed the value specified in **5.101**, for any possible combination of individual impulses.

Compliance is checked by the measurements specified in **5.101**.

5.103 For types A and B energizers which have terminals for the connection of the battery, the no-load d.c. output voltage shall not exceed 42.4V.

Compliance is checked by measuring the no-load d.c. output voltage appearing at the terminals for the connection of the battery when the energizer is connected for mains supply and is supplied at rated voltage.

5.104 The peak value of the output voltage, U_0, shall be measured and recorded to enable the tests and measurements of **14.102, 14.103, 14.104, 16.3** and **29.1** to be carried out.

Compliance is checked by the following test.

The peak value of the output voltage is measured, using the measuring arrangement described in **5.101** with the energizer supplied with the voltage in **11.5** under condition of normal operation, but with a load connected to the output terminals consisting of a capacitor having a capacitance which can be varied between 0 nF and 200 nF in steps of approximately 10 nF.

6 CLASSIFICATION

This clause of IS 302-1 (1979) is applicable except as follows.

6.1 Replacement

Mains-operated energizers and battery-operated energizers suitable for connection to the mains shall be class II with respect to protection against electric shock.

Compliance is checked by inspection and by the relevant tests.

6.2 Replacement

Energizers shall be of at least IPX4 construction.

Compliance is checked by inspection and by the relevant tests.

7 MARKING AND INSTRUCTIONS

This clause of IS 302-1 (1979) is applicable except as follows.

7.1 Addition

Energizers shall be marked with the words 'Read full instructions before use'.

Types A, B and C energizers shall be marked with the rated voltage for battery supply or rated voltage range for battery supply, in volts.

Battery-operated energizer shall be marked with the substance of the following 'WARNING — Do not connect to the mains-operated equipment'.

Medium power energizers which are marked with a maximum energy per impulse exceeding 5J shall also be marked with the corresponding load resistance at which the maximum energy per impulse is obtained.

7.6 Addition

 .....output (Fence)

 .....output (Earth)

7.12 Addition

Instructions for use of types A, B and D energizers shall

— include a warning against using non-rechargeable batteries; and

— state that, during charging, lead-acid batteries must be placed in a well ventilated area.

The instructions for use for battery-operated energizers shall in particular emphasize the warning marked on the energizer, which states the substance of the following 'WARNING — Do not connect to mains-operated equipment'.

7.101 Unless the correct mode of connection is obvious, marking shall clearly and indelibly identify the output terminals with the words EARTH and FENCE, or with the appropriate symbols.

Where alternative output terminals are provided they shall be similarly marked, or marked with the words FULL POWER, REDUCED POWER or REDUCED VOLTAGE, as appropriate.

If a switch to control the output energy is provided, the various positions of the switch shall be marked with the appropriate symbols, or with the words FULL POWER, REDUCED POWER or REDUCED VOLTAGE, as appropriate. The lettering of the marking shall have a height of at least 3 mm and the symbols a height of at least 6 mm.

Compliance is checked by inspection and measurement.

7.102 For types A, B, C and D energizers and battery-operated energizers the supply terminals for connection of the battery shall be clearly indicated by the symbol '+' or the colour red, if of positive polarity, and by the symbol '—' of the colour black, if of negative polarity, unless the polarity is irrelevant.

Compliance is checked by inspection.

8 PROTECTION AGAINST ELECTRIC SHOCK

This clause of IS 302-1 (1979) is applicable except as follows.

8.1 Addition

Appliance shall be constructed and enclosed so that there is adequate protection against accidental contact with live parts.

Compliance is checked by inspection and by the tests of **8.1** to **8.9** as applicable.

The means for the connection of the fence is not considered to be a live part.

8.2 This clause of IS 302-1 (1979) is not applicable.

9 STARTING OF MOTOR-OPERATED APPLIANCES

This clause of IS 302-1 (1979) is not applicable.

10 INPUT

This clause of IS 302-1 (1979) is applicable except as follows.

10.101 The maximum energy per impulse delivered by medium power energizers shall not deviate from the value marked on the energizer, if any, by more than ±10 percent and the load resistance at which it is obtained shall not deviate from the value marked on the energizer by more than ±5 percent.

Compliance is checked by the following test.

The energizer is supplied at rated voltage or rated voltage for battery supply, as appropriate, under conditions of normal operation but with a variable resistive load connected across its output terminals.

The energy per impulse dissipated in the resistive load connected across the energizer output terminals is measured using the measuring arrangement described in **5.101**. The resistive load value is measured after it is adjusted to maximize the energy per impulse measured.

NOTE — This test is only applicable to medium power energizers, which are marked with a maximum energy per impulse exceeding 5J.

11 TEMPERATURE RISE

This clause of IS 302-1 (1979) is applicable except as follows.

11.2 Addition

For type A energizers when connected for mains supply, type D energizers when connected for battery charger supply and type B energizers when connected for mains supply with battery charge operation, a battery of the largest type for which the energizer is designed is connected to the terminals for the connection of the battery supply. Before starting the test, the battery is discharged to such an extent that

the voltage delivered by the battery does not exceed 0.75 times its normal value.

11.5 Replacement

The energizer is operated under normal operation, supplied as follows:

— A mains-operated energizer is supplied with the most unfavourable supply voltage between 0.85 and 1.1 times rated voltage.

— Types A and C energizers, when they are connected for mains supply, are supplied with the most unfavourable supply voltage between 0.85 and 1.1 times rated voltage.

— A type B energizer, when it is connected for mains supply with battery charge operation, is supplied with the most unfavourable supply voltage between 0.85 and 1.1 times rated voltage.

— Types A,B, C and D energizers, when they are connected for battery supply, and battery-operated energizers are supplied at the terminals for the connection of the battery with the most unfavourable supply voltage between:

- 0.55 and 1.1 times rated voltage for battery supply, if the energizer can be used with non-rechargeable batteries; and
- 0.75 and 1.1 times rated voltage for battery supply, if the energizer is designed for use with rechargeable batteries only.

The values specified in table 101 for the internal resistance per cell of the battery shall be taken into account.

— Type D energizers, when they are connected for battery charger supply, are supplied from a source incorporating a series resistance of 1 ohm and having the form of:

- a half-wave rectified sine-wave with an r.m.s value equal to the rated voltage for battery supply,
- a full-wave rectified sine-wave with an r.m.s value equal to the rated voltage for battery supply,

whichever is the more onerous.

11.7 Replacement

The energizer is operated until steady conditions are established.

12 OPERATION UNDER OVERLOAD CONDITIONS

This clause of IS 302-1 (1979) is not applicable.

13 ELECTRICAL INSULATION AND LEAKAGE CURRENT AT OPERATING TEMPERATURE

This clause of IS 302-1 (1979) is applicable except as follows.

13.1 Modification

Compliance is checked by the tests of **13.2** and **13.3** for mains-operated energizers and battery-operated energizers suitable for connection to the mains only.

Addition

The energizer is operated under normal operation when supplied as specified in **11.5** for mains operation.

14 RADIO AND TELEVISION INTERFERENCE SUPPRESSION

This clause of IS 302-1 (1979) is applicable except as follows:

14.1 Not applicable

Table 101 Battery Source Impedance

Supply to the Terminals for the Connection of the Battery	Internal Resistance per cell ohm	
	Non-rechargeable Batteries	Rechargeable Batteries
1.1 times rated voltage for battery supply	0.08	0.0012
1.0 times rated voltage for battery supply	0.10	0.0015
0.75 times rated voltage for battery supply	0.75	0.0060
0.55 times rated voltage for battery supply	2.00	—

NOTE — When determining the internal resistance of a battery, two or more cells connected in parallel are considered to be one cell.

Additional Sub-clauses

14.101 Energizers shall be resistant to atmospheric surges entering from the fence or from the mains.

Compliance is checked by the tests of

— **14.102** to **14.105** for mains-operated energizers and types A,B and C energizers;

— **14.102** to **14.104** for type D energizers; and

— **14.104** for battery-operated energizers with a rated voltage exceeding 42.4 V.

NOTE — The value of U_0 is the peak value of the energizer output voltage obtained during the test of **5.104**.

Unless otherwise specified, during the tests, no disruptive discharges shall occur but surge protection devices are allowed to operate.

Mains-operated energizers and types A, B, C and D energizers are fixed to a metal plate having dimensions which are at least 150 mm in excess of those of the orthogonal projection of the energizer on the plate, and are then installed as in normal use.

Battery-operated energizers are installed as in normal use.

The tests are made by means of an impulse generator producing positive and negative full lightning impulses having a front time of 1.2 µs and a time to half-value of 50 µs, the tolerances being:

± 5 percent for the peak value,

± 30 percent for the front time, and

± 20 percent for the time to half-value.

Small oscillations in the impulse are allowed, provided their amplitude near the peak of the impulse is less than 5 percent of the peak value. For oscillations during the first half of the front time, amplitudes up to 10 percent of the peak value are allowed.

The shape of the impulses is adjusted with the energizer connected to the impulse generator. The adjustment shall be made at approximately 50 percent of the test voltage specified. If for the test of **14.104** or **14.105**, it is not possible to obtain the correct shape of the impulses, it is only necessary to ascertain that the front time has the required value at approximately 50 percent of the prospective peak voltage specified.

The impulse generator to be used for the tests shall have an energy content of at least 125J at the test voltage.

NOTE — More information with regard to the test method is given in IS 2071 (Parts 1 and 2).

14.102 Five positive and five negative impulses, each having a prospective peak voltage of 2 U_0 but not less than 25kV, are applied between

— the output terminals and a.c. input terminals connected together and the metal plate, for mains-operated energizers and types A, B and C energizers;

— the output terminals and the metal plate, for type D energizers;

the interval between consecutive impulses being at least 10 s.

14.103 Five positive and five negative impulses, each having a prospective peak voltage of 2 U_0 but not less than 25kV, are applied between the output terminals connected together and

— the a.c. input terminals connected together, for mains-operated energizers and types A, B and C energizers;

— the terminals for connection of the external battery charger, for type D energizers;

the interval between consecutive impulses being at least 10 s.

if during this test a surge protection device operates the test is repeated with the surge protection device rendered inoperative. During the repeat test no disruptive discharges are allowed.

If the energizer has more than one fence circuit, each fence circuit is subjected to this test in turn, the other fence circuits being open-circuited.

14.104 Five positive and five negative impulses, each having a prospective peak voltage of 2 U_0 but not less than 25 kV, are applied between the output terminals, the interval between the impulses being at least 10 s. The input terminals are open-circuited.

14.105 Five positive and five negative impulses, each having a prospective peak voltage of 5 kV, are applied between the a.c. input terminals, the interval between consecutive impulses being at least 10 s. The output terminals are short-circuited.

15 MOISTURE RESISTANCE

This clause of IS 302-1 (1979) is applicable.

16 INSULATION RESISTANCE AND ELECTRIC STRENGTH (AFTER HUMIDITY TREATMENT)

This clause of IS 302-1 (1979) is applicable except as follows.

16.1 Modification

Compliance is checked by the tests of

— **16.2**, **16.3** and **16.102** for mains-operated energizers and battery-operated energizers suitable for connection to the mains; and

— **16.101** and **16.102** for battery-operated energizers.

16.2 Modification

The test voltage is the upper limit of the voltage in **11.5.**

16.3 Addition

Other values of the test voltages and the points of application are shown in table 102.

Table 102 Additional Test Voltages

Points of Application	Test Voltage[1)]
Between the supply circuit and accessible parts for metal-encased class II energizers	2 U_0 but not less than 10 000V
Between the fence circuit and accessible parts[2)]	2 U_0 but not less than 10 000V
Between the supply circuit and the fence circuit	2 U_0 but not less than 10 000V

[1)] The value 2 U_0 is a peak value equal to twice the maximum peak value of the output voltage measured in **5.104**.

[2)] A gap of 50 mm around the output terminal shall be provided in the metal foil in contact with accessible parts.

16.101 For battery-operated energizers the supply terminals are connected for 10 min to a voltage between 1.1 and 1.5 times rated voltage for battery supply, which is so chosen that the output voltage, without a load connected, has the maximum value, protective spark gaps, if any, being disconnected.

The insulation between the poles of the supply circuit is then subjected for 1 min to a d.c. voltage of approximately 500V. Before this test is made capacitors, resistors, inductors, transformer windings and electronic components which are connected between the poles of the supply circuit are disconnected.

When a capacitor forms part of an integrated circuit and cannot be disconnected separately, the circuit as a whole is disconnected.

No breakdown shall occur during the test.

16.102 Immediately after the tests of **16.3** and **16.101**, the output characteristics are measured as specified in **5.101**.

The values measured shall be within the limits specified in **5.101** and shall not deviate in an unfavourable way by more than 10 percent from the values measured during the tests of **5.101**.

17 OVERLOAD PROTECTION

This clause of 302-1 (1979) is not applicable.

18 ENDURANCE

Energizers shall be so constructed that they are able to endure extreme temperatures that may be encountered in normal use. Moreover, overload protection devices shall not operate under these conditions.

Compliance is checked by the following test.

Mains-operated energizers and types A and C energizers when they are connected for mains supply are operated under conditions of normal operation. The voltage applied is the rated voltage.

Type D energizers, when connected for battery charger supply, are operated under conditions of normal operation. The voltage applied is as specified in **11.5**.

Battery-operated energizers and type B energizers connected for battery operation are placed in their normal position and are fitted with a battery having a nominal voltage equal to the rated voltage for battery supply of the energizer. The battery shall be of the largest type for which the energizer is designed. The battery shall be fully charged at the beginning of the test and shall be replaced by a fresh one as soon as during the test, the voltage of the battery decreases to 0.75 times its nominal voltage for a rechargeable battery or to 0.55 times its nominal voltage for a non-rechargeable battery.

For types A and D energizers, a battery of the largest type for which the energizer is designed connected and placed in the battery compartment. Before starting the test the battery is discharged to such an extent that the voltage delivered does not exceed 0.75 times its nominal value.

The other sample, for types A and C energizers, is to be connected for battery supply and supplied from a battery of the largest type for which the energizer is designed. The battery shall be fully charged at the beginning of the test, and shall be replaced by a fresh

one as soon as, during the test, the voltage of the battery decreases to 0.75 times its nominal voltage for a rechargeable battery or to 0.55 times its nominal voltage for a non-rechargeable battery.

The energizer is operated continuously for 168 h (seven days) at an ambient temperature of 15 ± 2°C and then for 168 h (seven days) at an ambient temperature of 50 ± 2°C.

The output terminals are loaded with a non-inductive resistor of 500 ± 2.5 ohm during the first 84 h of each period of 168 h and the load is removed for the remainder of these periods.

At the end of each of the periods of 168 h, the output characteristics are measured, as specified in **5.101**, at the ambient temperature prescribed for the relevant period.

The values measured shall be within the limits specified in **5.101** and shall not deviate in an unfavourable way by more than 10 percent from the values measured during the test of **5.101**.

During the test, the energizer shall show no change impairing its further use, the sealing compound, if any, shall not flow out to such an extent that live parts are exposed and the energizer shall meet the requirements of **8**.

19 ABNORMAL OPERATION

This clause of IS 302-1 (1979) is applicable except as follows.

19.1 Modification

Instead of the indication of the subclauses applicable to the various types of appliances, the following applies:

Energizers are subjected to the tests of **19.11**, **19.102**, **19.103** and **19.104**.

Addition

The energizer is mounted as in **11.2**, except that the battery, where applicable, is fully charged.

During the tests, fuses that are accessible to the user are short-circuited.

19.11 Replacement

Compliance for electronic circuits is checked by evaluation of the fault conditions specified in **19.11.2** for all circuits or parts of circuits, unless they comply with the conditions specified in **19.11.1**.

If the safety of the appliance under any of the fault conditions depends on the operation of a miniature fuse-link the test of **19.105** is made.

During and after each test, the temperature of the windings shall not exceed the values specified in **19.6** of IS 302-1 and the appliance shall comply with the conditions specified in **19.106**. In particular, live parts shall not be accessible to the test finger or the test pin, as specified in **8** of IS 302-1 (1979).

If a conductor of a printed circuit board becomes open-circuited, the appliance is considered to have withstood the particular test, provided all three of the following conditions are met:

— the material of the printed circuit board withstands the burning test;

— Any loosened conductor does not reduce the creepage distances or clearances between life parts and accessible metal parts below the values specified in **29** of IS 302-1 (1979);

— The plains withstands the tests of **19.11.2** with the open circuit conductor bridge

NOTES

1 Unless it is necessary to replace components after any of the tests, the electric strength tests of **19.106** need only be carried out after the final tests on the electronics circuit.

2 In general, examination of the plains and its circuit diagram will reveal the fault conditions which have to be simulated, so that testing can be limited to those spaces which may be expected to give the most unfavourable results.

3 In general, the tests take into account any failure which may arise from perturbations on the mains supply. However, where more than one component may be affected simultaneously, it may be necessary to carry out additional tests which are under consideration.

19.11.1 Fault conditions to specified in **19.11.2** are not applied to circuits or parts of circuits where both of the following conditions are met:

— the electronic circuit is a low-power circuit as described below;

— the protection against electric shock, fire hazard mechanical hazard or dangerous malfunction in other parts of the appliance does not rely on the correct functioning of the electric circuit.

A low power circuit is determined as follows:

The appliance is supplied at rated voltage and variable adjusted to its maximum resistance is connected between the point to be investigated and the opposite pole of the supply source.

The resistance is then decreased until the power consumed by the resistor reaches a maximum. Points

closest to the supply at which the maximum power delivered to this resistor does not exceed 15 W of 5 s are called low-power points. The part of the circuit farther from the supply source than a low-power point is considered to be a low-power circuit.

NOTES

1 The measurements are made from only one pole of the supply source, preferably the one that gives the fewest low-power points.

2 When determining the low-power points, it is recommended to start with points close to the supply source.

3 The power consumed by the variable resistor is measured by a wattmeter.

Components except the major switching device, directly related to the pulse interval timing of the major switching device where this is an electronic component, are exempt from the test of **19.11.2**.

19.11.2 The following fault conditions are considered and, if necessary, applied one at a time. Consequential faults are taken into consideration:

a) Short circuit of creepage distances and clearances between live parts of different potential, if these distances are less than the values specified in **29.1**, unless the relevant part is adequately encapsulated;

b) Open circuit at the terminals of any component;

c) short circuit of capacitors;

d) Short circuit of any two terminals of an electric component, other than integrated circuits. This fault condition is not applied between the two circuits of an optocoupler;

e) Failure of triacs in the diode mode; and

f) Failure of an integrated circuit. In this case the possible hazardous situations of the appliance are assessed to ensure that safety does not rely on the correct functioning or such a component.

All possible output signals are considered under fault conditions within the integrated circuit. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered.

NOTES

1 Components such as thyristors and triacs are subjected to fault conditions (b) and (d).

2 Microprocessors are tested as integrated circuit.

In addition, each low-power circuit is short-circuited by connecting the low-power point to the pole of the supply from which the measurements were made.

For simulation of the fault conditions, the appliance is operated under the conditions specified in **11** of IS 302-1 but supplied at rated voltage.

When any of the fault conditions are simulated, the duration of the test is:

— as specified in **11.7** of IS 302-1 (1979) but only for one operating cycle and only if the fault cannot be recognized by the user, for example, change in temperature;

— as specified in **11.7** of IS 302-1 (1979), if the fault can be recognized by the user, for example, when the motor of a kitchen machine stops;

— Until steady conditions are established, for circuits continuously connected to the supply mains, for example, stand-by circuits.

In each case, the test is ended if interruption of the supply occurs within the appliance.

Fault conditions (f) if applied to encapsulted and similar components if the circuit cannot be assessed by other methods.

Positive temperature coefficient resistors (PTC's) are not short-circuited if they are used within their manufacturer's declared specification.

Additional Sub-clauses

19.101 Energizers are subjected to each of the following conditions in turn, while being supplied with the voltage specified in **11.5**, including those associated with such other fault conditions that are an actual consequence of the condition chosen:

— The energizer is placed in its most unfavourable position even if it is not likely to be installed in this position in normal use;

— Parts intended for adjusting the energizer, other than those which are adjustable from the outside of the energizer without the aid of a tool, are adjusted to their most unfavourable position, even if these parts are not intended to be adjusted by the user, unless they are effectively sealed against further adjustment;

— The earthing conductor is removed from the earthing terminal of the fence circuit and connected to any other output terminal;

— The output terminals are short-circuited;

— Switches, relay-contacts and the like, which form part of the impulse device, are short-circuited or open-circuited, whichever is the

more unfavourable;

— Fuses that are accessible without the aid of tools, series spark gaps in the fence circuit, discharging valves and thermal relays are short-circuited;

— Except for electronic circuits, any creepage distance or clearance between live parts of different potential which is less than 5 mm for the fence circuit, or 2 mm or less for other circuits, is short-circuited and any unlocked connection is loosened;

— The switching speed of an electronic component used as the major pulse switching device shall be varied in the range 0.1Hz to twice the rated frequency, in approximately a 1:2:5 progression sequence over three decades, by referencing the gate signal of this device to the voltage across it using an external independent control.

NOTE — Details of a simple comparator circuit which has been found suitable for controlling the switching speed of the major pulse-switching device are given in Annex AA.

19.102 Types A,C and D energizers are subjected to each of the following conditions in turn, while being supplied with the voltage specified in **11.5**:

— with the energizer connected for battery supply, terminals for the connection of the battery having an indication of polarity are connected to the opposite polarity, unless such a connection is unlikely to occur in normal use;

— with the energizer connected for mains operation, terminals for the connection of the battery supply are connected to the most unfavourable load, including a short-circuit.

19.103 Type B energizers connected for mains supply with battery charge operation are subjected to each of the following conditions in turn, while being supplied with the voltage specified in **11.5**:

— the terminals for the connection of the battery having an indication of polarity are connected to the opposite polarity, unless such a connection is unlikely to occur in normal use;

— the terminals for the connection of the battery supply are connected to the most unfavourable load, including a short-circuit.

19.104 Battery-operated energizers and type B energizers connected for battery supply are supplied with the voltage specified in **11.5**. the supply terminals having an indication of polarity are connected to the opposite polarity, unless such a connection is unlikely to occur in normal use.

19.105 If, for any of the fault conditions in **19.11.2**, the safety of the appliance depends on the operation of a miniature fuse-link, the test is repeated but with the miniature fuse-link by an ammeter.

If the current measured does not exceed 2.1 times the rated current of the fuse-link the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuit.

If the current measured is at least 2.75 times the rated current of the fuse-link, the circuit is considered to be adequately protected.

If the current measured exceed 2.1 times the rated current of the fuse-link but does not exceed 2.75 times the rated current, the fuse-link is short-circuited and the test is carried out.

— for quick acting fuse-links, for the relevant period or for 30 min, whichever is the shorter;

— for time lag fuse-links, for the relevant period or for 2 min, whichever is the shorter.

NOTES

1 In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.

2 The verification whether the fuse-link acts as a protective device is based on the fusing characteristics, which also gives the information necessary to calculate the maximum resistance of the fuse-link.

3 Other fuses are considered to be intentionally weak parts in accordance with **19.1**.

If, for any of the fault conditions, the impulse repetition is greater than 1 Hz and the safety of the energizer depends upon the operation of a non-self-resetting protective device incorporating an internal fuse, the test is carried out three times to ensure that this fuse operates reliably and that internal parts are not damaged at the increased impulse repetition rate.

19.106 During the tests the appliance shall not emit flames, molten metal, poisonous or ignitable gas in hazardous amounts and temperature rises shall not exceed the values shown in table below:

Part	*Temperature rise* K
Walls, ceiling and floor of the test corner[1)]	150
Insulation of supply cord[1)]	150
Supplementary insulation and reinforced insulation	1.5 times the relevant value specified in

other than those of thermoplastic materials[3]	Table 1 of IS 302-1 (1979)[2]

[1] For motor operated appliances these temperatures are not determined.

[2] This value is under consideration.

[3] There is no specific limit for supplementary insulation and reinforced insulation of thermoplastic material. However, the temperature rise has to be determined so that the test of **30.1** of IS 302-1 (1979) can be carried out.

After the tests and when the appliance has cooled to approximately room temperature, enclosures shall not have deformed to such an extent that compliance with **8** is impaired and, if the appliance can still be operated, it shall comply with **20.2** of IS 302-1 (1979).

After the tests, the insulation other than that of class III appliances, when it has cooled down to approximately room temperature, shall withstand the electic strength test is **16.4** of IS 302-1 (1979), the test voltage however being

— 1 000 V for basic insulation

— 2 750 V for supplementary insulation

— 3 750 V for reinforced insulation

During the tests the output characteristics shall be as specified in **5.101**, except for the inpulse repetition rate.

If the impulse repetition rate is greater than 1.34 Hz, the discharge energy per second into a load consisting of a non-inductive resistor of 500 ohm shall not exceed 2.5 J/s for a period exceeding 3 min before the energizer is rendered inoperative by a non-self-resetting protective device.

The temperature rises of the windings shall not exceed the values shown in **19.6** of IS 302-1 (1979).

20 STABILITY AND MECHANICAL HAZARDS

This clause of IS 302-1 (1979) is not applicable.

21 MECHANICAL STRENGTH

This clause of IS 302-1 (1979) is applicable except as follows.

21.101 The energizer shall withstand the effect of being dropped.

Compliance is checked by the following test.

The energizer is bolted centrally to a board 1 000 ± 5 mm long by 225 ± 5 mm wide and approximately 25 mm thick. The board is supported at each end on a rigid table by baulks of timber of such a size that the energizer is held clear of the table surface. One end of the board is lifted through a distance of 200 ± 5 mm and allowed to fall freely. The test is repeated 20 times. This procedure is then repeated with the board placed on each of its other longitudinal edges in turn.

After the test, the energizer shall show no damage within the meaning of this standard.

22 CONSTRUCTION

This clause of IS 302-1 (1979) is applicable except as follows.

22.31 and 22.32 Modification

The requirement applies only to mains-operated energizers and battery-operated energizers suitable for connection to the mains.

22.101 For mains-operated energizers and battery-operated energizers suitable for connection to the mains, internal connections shall be so fixed or protected, and energizers shall be so designed that, even in the event of the loosening or breaking of wires, a conductive connection cannot be formed between the mains supply and the fence circuit, and no other hazardous conditions shall arise.

The input winding and the output windings of transformers used to isolate the fence circuit from the supply circuit shall be separated by an insulating barrier, and the construction shall be such that there is no possibility of any connection between these windings, either directly or indirectly through other metal parts.

In particular, precautions shall be taken to prevent

— displacement of input or output windings, or the turns thereof;

— undue displacement of parts of windings, or of internal wiring, in the event of a rupture of loosening of connections.

Compliance is checked by inspections and by the tests of the other clauses of this standard.

NOTES

1 Isolation between the mains and the fence circuit may be achieved by the incorporation of a double-wound transformer situated either in the input circuit or the fence circuit. If such transformers are incorporated in both circuits, at least one of these transformers should provide the required degree of isolation.

2 Circuits connected between the input terminals and the primary side of the transformer providing the required degree of isolation are considered to be connected to the mains, and circuits connected between the output terminals and the secondary side of this transformer are considered to belong to the fence circuit.

3 Examples of constructions, which comply, with the requirements of this subclause for windings are:

— windings on separate spools of adequate insulating material, rigidly fixed with respect to each other and to the core of the transformer;

— windings on a single spool with a partition wall, both of adequate insulating material, provided that the spool and partition wall are pressed or moulded in one piece, or that, in the case of a pushed-on partition wall, there is an intermediate sheath or covering over the joint between the spool and the partition wall;

— concentric windings on cheekless formers, provided that;

- each layer of the winding is interleaved with adequate insulating material projecting beyond the end turns of each year,
- one or more separate sheets of insulating material of adequate thickness are provided between the input winding and the output windings, and
- the windings are impregnated with a hard-baked or other suitable material which fully penetrates the interstices and effectively seals off the end turns.

4 It is not to be expected that two independent fixings will become loose at the same time.

22.102 For mains-operated energizers and battery-operated energizers suitable for connection to the mains, transformers in the fence circuit shall be placed in a separate compartment. This compartment shall not contain any part, which is, or can come, in contact with the mains, with the exception of the input winding of the transformer. The bushings referred to in **22.105** shall be in the wall of this compartment.

Compliance is checked by inspection and by tests of the other clauses of this standard.

22.103 For metal-encased class II energizers, the output terminals shall be placed so that external conductors connected to these terminals are not likely to come into contact with the enclosure.

Compliance is checked by inspection.

22.104 Mains-operated energizers and battery-operated energizers suitable for connection to the mains shall be so designed that

— the conductors for the connection of the fence and the earth electrode can be easily connected;

— it is possible to actuate switches and other controls, necessary in normal use, after the energizer has been mounted and connected to the mains, without opening or removing any enclosure which provides protection against harmful ingress of water or unintended electric shock.

Battery-operated energizers shall be so designed that

— the conductors for the connection of the fence and the earth electrode can be easily connected;

— it is possible to actuate switches and other controls, if this is necessary in normal use.

Compliance is checked by inspection.

22.105 Where conductor of the fence circuit pass through the enclosure, bushings of insulating material suitable for the relevant working voltage and for outdoor conditions shall be provided to allow the conductors to pass, unless the enclosure is of insulating material suitable for the relevant working voltage and for outdoor conditions.

Compliance is checked by inspection.

NOTE — For mains-operated energizers and battery-operated energizers suitable for connection to the mains. material complying with the test of **30.3** is considered to be suitable for the relevant working voltage and for outdoor conditions.

22.106 For mains-operated energizers and battery-operated energizers suitable for connection to the mains, any assembly gap in supplementary insulation shall not be co-incidental with any such gap in basic insulation, neither shall any such gap in reinforced insulation give straight access to live parts.

Compliance is checked by inspection.

22.107 In types A, B and C energizers, terminals for the connection of the battery and other metal parts in a battery compartment which become accessible when replacing batteries, even with the aid of a tool, shall be insulated from live parts by double insulation or reinforced insulation.

In type D energizers and battery-operated energizers, parts in a battery compartment which become accessible when replacing, even with the aid of a tool, shall not be live parts.

Compliance is checked by inspection, measurement and by the tests specified for double insulation or reinforced insulation.

22.108 Battery-operated energizers and battery-operated energizers suitable for connection to the mains shall be provided with means to prevent the user from being subjected to an electric shock due to the energizer output voltage, when connecting a battery to the energizer.

Compliance is checked by inspection.

NOTE — Examples of such means are:

— a switch which isolate the terminals for the connection of the battery;

— a control which enables the output voltage to be reduced to zero;

— insulated crocodile clips are similar devices.

23 INTERNAL WIRING

This clause of IS 302-1 (1979) is applicable except as follows.

23.7 Replacement

For mains-operated energizers and battery-operated energizers suitable for connection to the mains, conductors identified by the colour combination green/yellow shall not be used .

Compliance is checked by inspection.

24 COMPONENTS

This clause of IS 302-1 (1979) is applicable.

25 SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLE AND CORDS

This clause of IS 302-1 (1979) is applicable except as follows.

25.1 Addition

Type D energizers shall be provided with a non-detachable flexible cord with connecting means that are not suitable for connection to the mains, or an appliance inlet, having at least the same degree of protection against moisture as required for the energizer, that is not compatible with appliance couplers complying with the standard sheets of IS 3010 (Part 1) : 1965 and IS 3010 (Part 2) : 1965.

Compliance is checked by inspection.

25.2 Modification

Replace the table by the following table:

Number of Conductors	Maximum Overall Diameter mm	
	Cable	Conduit
2	13.0	16.0

25.4 Addition

The flexible leads or flexible cord used to connect the battery in battery-operated energizers shall be assembled with the energizer by a type X attachment.

25.6 Replacement

Supply cords, other than the flexible leads or flexible cord connecting an external battery or battery box with an energizer, shall not be lighter than

— ordinary polyvinyl chloride sheathed cord;

— ordinary polychloroprene sheathed cord;

The ordinary polychloroprene sheathed cord shall be used where, for climatic reasons, the ordinary polyvinyl chloride sheathed cord is not suitable.

Compliance is checked by inspection.

The conductors in flexible leads or flexible cords used to connect the battery in battery-operated energizers shall have a nominal cross-sectional area of not less than 0.75 mm^2.

25.8 Addition

The requirement is not applicable to the flexible leads or flexible cord connecting external batteries or a battery box with an energizer.

Additional Sub-clauses

25.101 In types A, B, C, D and battery-operated energizers, if the battery is placed in a separate box, the flexible lead or flexible cord connecting the box with the energizer is considered to be an interconnection cord.

25.102 Battery-operated energizers shall have suitable means for connection of the battery. If the type of battery is marked on the energizer, the means of connection shall be suitable for this type of battery.

Compliance is checked by inspection.

26 TERMINALS FOR EXTERNAL CONDUCTORS

This clause of IS 302-1 (1979) is applicable except as follows.

26.7 Addition

The requirement does not apply to the energizer output terminals.

26.10 Addition

The requirement does not apply to the energizer output terminals.

26.13 Addition

Terminal devices in an energizer for the connection of the flexible leads or flexible cord with type X attachment connecting an external battery or battery box shall be so located or shielded that there is no risk of accidental connection between supply terminals.

Additional Sub-clauses

26.101 Output terminals shall be so designed or located that it is not possible to connect the fence or the earth electrode to the energizer, by means of a plug which is designed for connection to a socket-outlet for mains supply.

Compliance is checked by inspection and by manual test.

26.102 Output terminals shall be fixed so that they will not work loose when external conductors are connected or disconnected.

Compliance is checked by inspection and by manual test.

26.103 Devices for clamping the conductors connecting the fence or the earth electrode to the energizer shall not serve to fix any other component.

Compliance is checked by inspection.

27 PROVISION FOR EARTHING

This clause of IS 302-1 (1979) is not applicable.

28 SCREWS AND CONNECTIONS

This clause of IS 302-1 (1979) is applicable.

29 CREEPAGE DISTANCES AND CLEARANCES

This clause of IS 302-1 (1979) is applicable except as follows.

29.1 Addition

The creepage distances and clearances are not applicable to battery-operated energizers, unless otherwise specified.

Creepage distances and clearances between:

— live parts of the fence circuit and other metal parts,

— metal enclosures and other metal parts of the energizer, including metal foil wrapped around the supply cord inside inlet bushings, cord guards, cord anchorages and similar parts, shall not be less than those shown in table 103.

The creepage distances and clearances between metal enclosures and metal parts of the output terminals shall be not less than 50 mm and 25 mm respectively.

The creepage distances and clearances between the poles of the supply circuit in battery-operated energizers shall be not less than 2 mm, when the energizer is fitted which conductors as in normal use.

Table 103 Creepage Distances and Clearances

Output Voltage[1] (Peak Value)	Creepage Distance mm	Clearance[2] mm
Up to and including 5 000 V	15	15
Over 5 000 V, up to and including 7 500V	25	25
Over 7 500 V	30	25

[1] As measured in **5.104**.

[2] The clearances specified do not apply across a spark gap or similar device, which is necessary for the correct functioning of the energizer.

30 RESISTANCE TO HEAT, FIRE AND TRACKING

This clause of IS 302-1 (1979) is applicable except as follows.

30.3 Addition

NOTE — Battery-operated energizers are subject to normal duty conditions.

In mains-operated energizers and battery-operated energizers suitable for connection to the mains, switching devices with moving contacts other than manually operated are regarded as being subjected to extra-severe duty conditions. In addition other parts of insulating material are also regarded as being subjected to extra severe duty conditions, unless these parts are so enclosed or located that pollution by moisture are dirt is unlikely to occur; in such a case. The requirements for severe duty conditions apply.

31 RESISTANCE TO RUSTING

Replacement

The enclosure of metal-encased class II energizers shall be adequately protected against corrosion.

Compliance is checked by the salt mist test described in IS 9000 (Part 11) : 1983, which is made on the energizer mounted in its normal position of use; the energizer is kept in the test chamber for 168 h (seven days).

Before and after this test, enclosures provided with a coating are scratched by means of a hardened steel pin, the end of which has the form of a cone with a top angle of 40 degree, its tip being rounded with a radius of 0.25 mm plus or minus 0.02 mm. The scratches are made by drawing the pin along the surface of the coaching at a speed of about 20mm/s, in the manner shown in Fig. 102. The pin is so loaded that the force exerted along its axis is 10N plus or minus 0.5 N. Each time, five scratches are made at least 5 mm apart and at least 5 mm from the edges of the coating.

After the test, the enclosure of the energizer shall show no sign of deterioration which could affect compliance with this standard and its coating, if any, shall not have loosened from the metal surface and shall not have been pierced.

32 RADIATION HAZARDS

This clause of IS 302-1 (1979) is applicable.

33 FINISH

This clause of IS 302-1 (1979) is not applicable.

101 TESTS

101.0 Categories of Tests

The test specified in table 104 shall constitute the type tests and shall be carried out on one sample selected preferably at random from a regular production lot. Before commencement of the tests, the fence engergizer shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, constructions mechanical hazards, markings provision of suitable terminals for supply connections, earthing and the effectiveness of screws and connections. The external surface finish shall be even and free from finishing defects.

101.1 Criteria of Acceptance

The sample shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, the testing authority at its discretion, may call for fresh samples not exceeding twice the original number and

Table 104 Schedule of Type Tests

(*Clause* 101.0)

Sl No.	Test	Clause Reference
i)	Protection against electric shock	8
ii)	Starting of motor-operated appliances	9
iii)	Input	10
iv)	Temperature rise	11
v)	Electrical insulation and leakage current at operating temperature	13
vi)	Moisture resistance	15
vii)	Insulation resistance and electric strength (after humidity treatment)	16
viii)	Overload protection	17
ix)	Abnormal operation	19
x)	Stability and mechanical hazards	20
xi)	Mechanical strength	21
xii)	Construction	22
xiii)	Internal wiring	23
xiv)	Components	24
xv)	Cord grip and cord guard	25
xvi)	Terminals for external conductors	26
xvii)	Provision for earthing	27
xviii)	Screws and connections	28
xix)	Creepage distances and clearances	29
xx)	Resistance to heat fire and tracking	30
xxi)	Resistance to rusting	31
xxii)	Radiation hazards	32

subject them again to all tests or to the test (s) in which failure(s) has occurred. No failure should be permitted in the repeat test(s).

101.2 Acceptance Tests

The following shall constitute the acceptance tests:

	Test	*Clasue Reference*
a)	Protection against electric shock	8
b)	Input	10
c)	Temperature rise	11
d)	Electrical insulation and leakage current at operating temperature	13
e)	Moisture resistance	15
f)	Insulation resistance and electric strength (after humidity treatment)	16
g)	Provision for earthing	27

NOTE — For the purpose of acceptance tests, the humidity treatment shall be done for 24 h while conducting the test for moisture resistance (15).

101.2.1 A recommended sampling procedure for acceptance tests is given in Appendix B of IS 302-1 (1979).

101.3 Routine Test

The following shall constitute the routine tests:

	Test	*Clause Reference*
a)	Protection against electric shock	8
b)	High voltage	13.3.2 of IS 302-1 (1979)
c)	Provision for earthing	27

101.4 BIS Certification Marking

The product may also be marked with the Standard Mark

101.4.1 The use of the Standard Mark is governed by the provision of *Bureau of Indian Standard Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

TABLES OF TYPE TEST

Appendix A of IS 302-1 (1979) is not applicable.

ANNEX B

SAMPLING PROCEDURE FOR ACCEPTANCE TESTS

Appendix B of IS 302-1 (1979) is applicable.

ANNEX C

ELECTRONIC CIRCUITS

Appendix C of IS 302-1 (1979) is applicable.

ANNEX D

MEASUREMENT OF TEMPERATURE WITH THERMOMETERS

Appendix D of IS 302-1 (1979) is applicable.

ANNEX E

ALTERNATIVE TESTS FOR PROTECTED MOTOR UNITS

Appendix E of IS 302-1 (1979) is not applicable.

ANNEX F

IMPACT TEST APPARATUS

Appendix F of IS 302-1 (1979) is applicable.

ANNEX G

THERMAL CONTROLS AND OVERLOAD RELEASES

Appendix G of IS 302-1 (1979) is not applicable.

ANNEX H

MEASUREMENT OF CREEPAGE DISTANCES AND CLEARANCES

Appendix H of IS 302-1 (1979) is applicable.

ANNEX J

TEST FOR FIRE RESISTING PROPERTIES

Appendix J of IS 302-1 (1979) is applicable.

ANNEX K

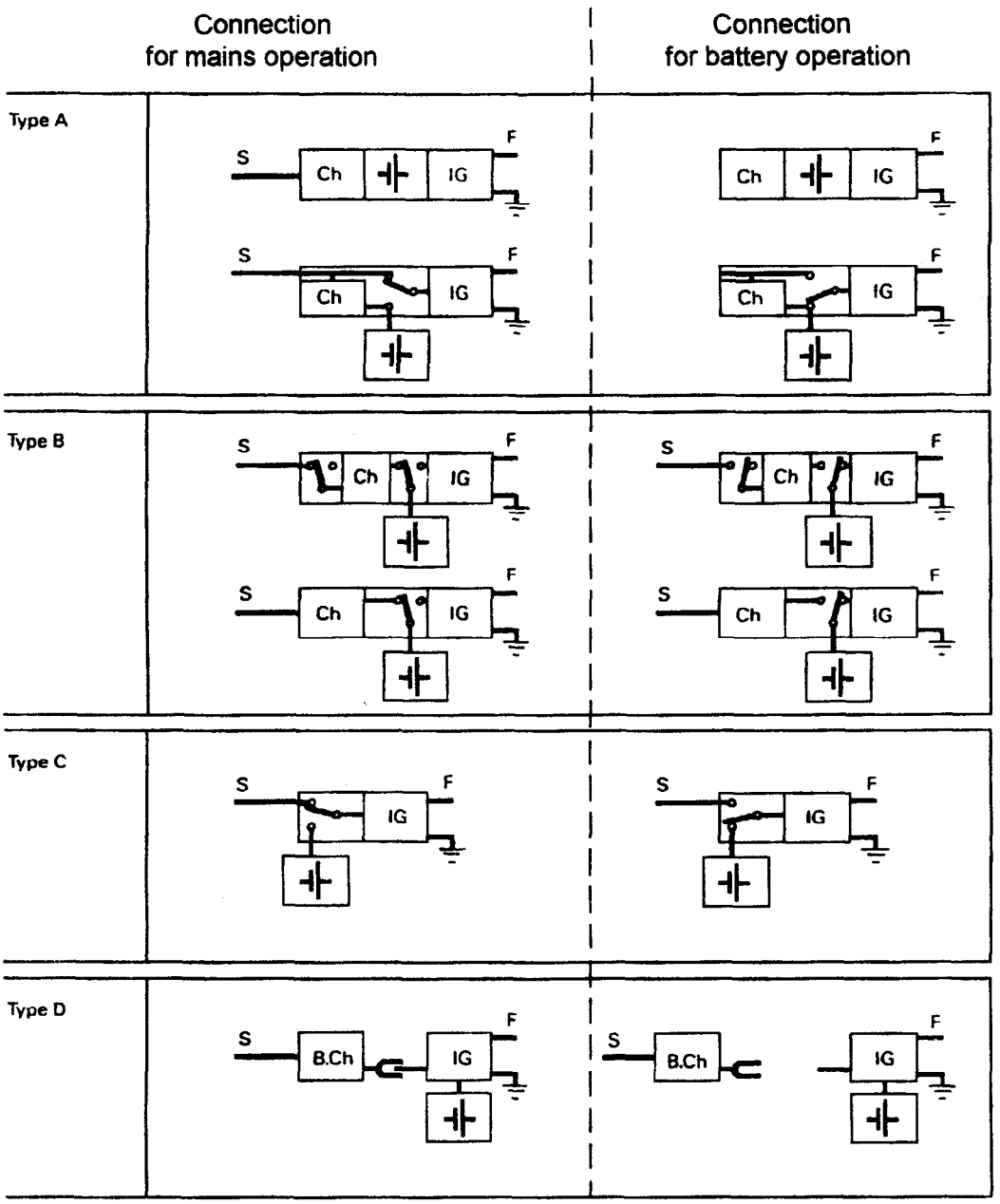
BNF JET TEST FOR DETERMINATION OF THICKNESS OF COPPER AND NICKEL PLATING

Appendix K of IS 302-1 (1979) is not applicable.

ANNEX L

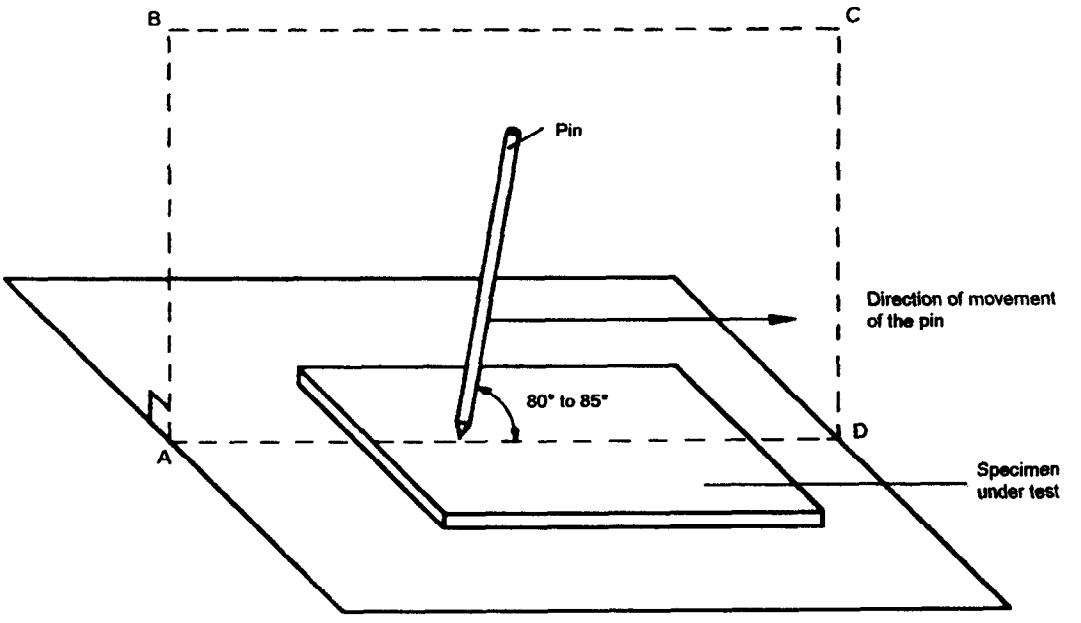
APPROXIMATE MEASUREMENT OF THICKNESS OF CHROMIUM ON NICKEL STEEL AND COPPER

Appendix L of IS 302-1 (1979) is not applicable.



S = supply mains
Ch = battery charger circuit
IG = impulse generating circuit
B.Ch = separate battery charger
= battery
F = fence connection

FIG. 101 SCHEMATIC EXAMPLES OF THE DIFFERENT TYPES OF BATTERY-OPERATED ENERGIZERS SUITABLE FOR CONNECTION TO THE MAINS



The pin is in the plane ABCD, which is perpendicular to the sample.

FIG. 102 SCRATCH TEST FOR COATED ENCLOSURES

Annex AA

(Note Under Clause **19.101***)*

(Informative)

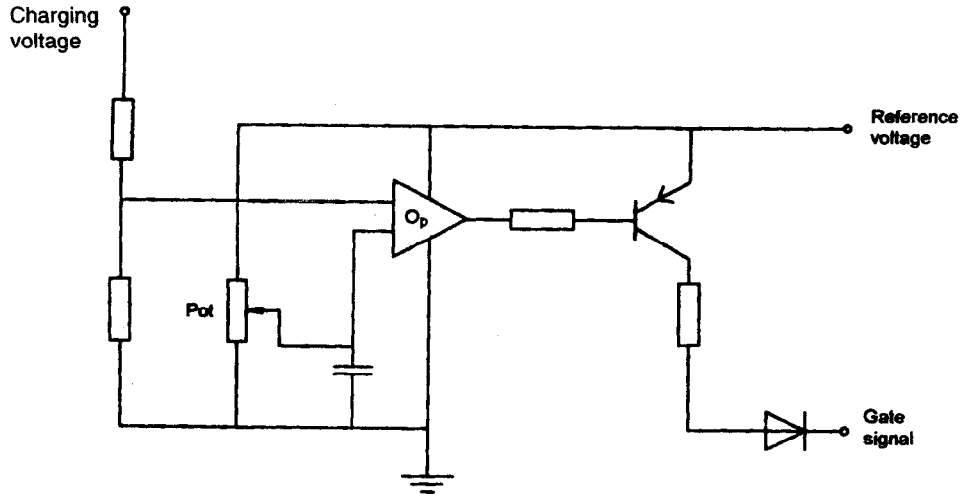
CIRCUIT FOR THE INDEPENDENT CONTROL OF THE SWITCHING SPEED OF THE MAJOR PULSE-SWITCHING DEVICE

A suitable circuit for external independent control of the switching speed of semiconductor devices used as the major pulse-switching device in the energizer, in accordance with the eighth dash item of **19.101**, is shown in Fig. AA.1.

The circuit is used to reference the gate signal of the major pulse-switching device to the voltage across this device so that it can be triggered at the same point in the charging cycle.

The reference voltage should be of such a value that the comparator is adjustable over the whole range of the energizer charging voltage, thereby allowing the switching speed to be set at any desired frequency.

The input impedance of the comparator circuit should be such that it does not influence the results of the test.



Pot = Switching speed adjustor
Op = Comparator

FIG. AA. 1 CIRCUIT FOR THE INDEPENDENT CONTROL OF THE SWITCHING SPEED OF THE MAJOR PULSE-SWITCHING DEVICE

ANNEX BB

(*Foreword*)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
302-1 (1979)	Safety of household and similar electrical appliances: Part 1 General requirements (*fifth revision*)
8437 (Part 1) : 1993/IEC 479-1 (1984)	Guide on effects of current passing through human body : Part 1 General aspects (*first revision*)
8437 (Part 2) : 1993/IEC 479-2 (1987)	Guide on effects of current passing through human body : Part 2 Special aspects (*first revision*)
2071 (Part 1) : 1993/IEC Pub 60-1 (1989)	High voltage test techniques : Part 1 General definitions and test requirements (*second revision*)
2071 (Part 2) : 1974	Methods of high voltage testing : Part 2 Test procedures (*first revision*)
3010 (Part 1) : 1965	Appliance-connectors and appliance-inlets (non-reversible three pin type) : Part 1 Appliance connectors
3010 (Part 2) : 1965	Appliance-connectors and appliance-inlets (non-reversible three pin type) : Part 2 Appliance inlet.
9000 (Part 11) : 1983	Basic environmental testing procedures for electronic and electrical items : Part 11 Salt mist test.

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This Indian Standard has been developed from Doc : No. ETD 32 (4054).

Amendments Issued Since Publication

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